Kepros - Wearable posture training diagnostic vest for physical therapy

PROJECT PLAN

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Project Statement

Keeping proper posture is important for average people and athletes in order to avoid back pain and improving performance while exercising. Currently, there is no easy way for a person to accurately measure their posture.

Athletes are looking for a way to determine how close their posture is to the desired posture while doing physical activities such as pitching. Also, many people would benefit from knowing how off their position is while doing everyday actions such as sitting.

System Description

Kepros' solution to this problem is a wearable device that is able to determine the wearer's posture and muscle fatigue levels. Kepros worked with a team last year to create the first rendition of this device. Currently, there is a slim shirt with velcro and buttons sewn on in order to attach gyroscopes and EMGs. The program is able to read raw data from the gyroscopes and EMGs attached to the shirt.

We are looking to improve the wearable by getting it to read more information and to make it more user friendly. This involves simplifying the design and making the data easier to understand. Right now, we are focusing on the device's use in Kepros' gym, but we also want it to be usable by anyone in their home.

Requirements

Hardware

1. The wearable must be able to:
    a. Fit a medium build
    b. Not hinder the wearer's movement
    c. Be hidden underneath a shirt
2. The wearable will be outfitted with 4 gyroscopes, 2 EMGs, and an accelerometer
    a. The EMGs may be attached to the body to get optimal readings
3. The wires and electronics need to be reasonably hidden

Software

1. The program needs to be able to read data from 10 minutes to 24 hours
2. The gyroscope and accelerometer data will be combined to determine when the user has good and poor posture
    a. We will allow a 10-15% error from the standard posture
3. The program will allow for a homeostasis value to be saved to determine muscle fatigue levels from the EMGs

4. The data must be able to tell the reader when the user is leaning, twisting, or slouching

Deliverables

Spring 2016

Since a large part of this project is testing and reading data in order to make the program more streamlined, we hope to have a working prototype by the end of this semester. In order to accomplish this, we plan to have all major changes to the shirt and hardware done. We will also write software that is able to record and store raw data from the gyroscopes and EMGs on a computer. Over the summer, Ted will be able to use this hardware and software to run tests to get us a large amount of data to work with

Fall 2016

Our goal for this semester is to get the wearable and program and device as close to commercialization as possible. With this in mind, we will study the data that Ted collected over the summer to determine proper posture in each position. We will then need to create a graph to show the user their posture at different times of the day. A similar graph will be made for the data from the EMG to determine muscle fatigue. We will then compare the data from these graphs to the data that is desired for proper posture to determine when the user has correct and incorrect posture. Another functionality that our new software will have is that it will convert the raw data to data that is easier to understand, such as angles instead of random numbers. After all functionality is finished, we will continue to run tests to smooth out the program.

Work Plan

Schedule

First 30 Days	Days 31- 60	Days 61 - 90	Days Afterward
Experiment with current code and determine hardware changes.	Make hardware changes and get raw information from the gyroscopes, accelerometer and EMGs.	Make graphs of the data read into the program.	Run tests to determine desired postures and EMG levels. Improve the program's performance.

Risks

The risks for this project are mostly software related. We have a large enough budget to purchase the hardware desired, and Kepros is readily available to us even though he works in Cedar Rapids. Kepros will be able to answer any physical therapy questions we have, but there might be a time when our advisors aren't able to answer all of our software questions. Kothari specializes more in security and Sauceda may have to move for a government project.

Also, the gyroscopes, accelerometer, and EMGs may not be able to get accurate readings while connected to the shirt. In addition, our program and hardware may not be fast and reliable enough to determine quick changes in posture over long periods of time.

Market Survey

Kepros introduced our team to two projects that were made to help wearer's with their posture. One was a shirt that weighed down areas of the wearer's torso to encourage them to stand up straight. The shirt, however, doesn't record any data. The other project was a waistband that told the user when their posture was off. This project also didn't record data, but it is also too simplistic. Since it only has one gyroscope, it is unable to determine the posture of the upper body.

Conclusion

We will be working with Ted Kepros, a physical therapist, to create a wearable device that records the wearer's posture. Currently, we are designing it to be used in practice by Kepros, but it may be used by others as well. We hope that the wearable will be able to help athletes improve and help everyone fix their back discomforts.